HYÆNODONTIDÆ OF THE UPPER EOCENE OF CALIFORNIA

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Since the announcement[1] of the discovery of upper Eocene mammals in the Sespe deposits north of the Simi Valley, California, excavations have been continued in these beds, particularly at Locality 150 C.I.T. Vert. Pale., by field parties of the California Institute. Recently an opportunity has been afforded the writer to compare a number of the mammalian types found here with related forms known from the late Eocene and Oligocene. This has permitted a more precise determination of the genera and species than was attempted in the original statement. It is planned therefore to present in this and in subsequent papers brief descriptions of individual types, reserving a fuller discussion for a monographic treatment of the Sespe faunas.

CREODONTA

Family Hyænodontidæ

Hyænodon vetus, n. sp.

Type Specimen.—Skull with upper dentition, No. 1243 C.I.T. Coll. Vert. Pale., plate 1, figure 1, textfigures 1 and 2.

Locality.—Sespe Upper Eocene, north of Simi Valley, Ventura County, California; Locality 150 C.I.T. Vert. Pale.

Specific Characters.—Larger than *Hyænodon crucians* and approaching *H. montanus* and *H. cruentus* in size. Skull slender with postorbital constriction relatively more pronounced than in Oligocene species. Depression of frontal surface between temporal ridges broad and relatively deep. Union of temporal ridges with sagittal crest slightly in advance of level of deepest portions of postorbital constriction. Posterior position of postglenoid processes like that in *crucians;* processes situated slightly farther back than in *paucidens* and in *mustelinus* but not so far back as in *cruentus* and in *horridus*. Backward extent of tooth-row not so great as in American Oligocene species. Anterior premolars closely spaced but not crowded. $P\frac{1}{1}$ with two well developed roots.

Remarks.—The beautifully preserved skull of *Hyænodon vetus* represents the first specifically determinable material of this genus to be recorded from an American Tertiary horizon older than the White River. No. 1243 exhibits several characters in which it may be regarded as more primitive than representatives of the genus in the American Oligocene. The

position of the posterior choanae varies in skulls of the latter. In *H. vetus* the floor to the postnarial passage apparently does not extend backward quite so far as in the Oligocene hyænodons. In No. 1243 the medial walls of the palatines are virtually in contact, in part due perhaps to lateral crushing which has affected this portion of the postnarial passage, but a narrow cleft appears to prevail between them extending forward farther than in the Oligocene forms. Likewise the pronounced postorbital constriction and possibly the lack of a noticeable backward extension of the tooth-row may be regarded as characters in which *H. vetus* is less advanced.

Hyænodon (Protohyænodon) exiguus, n. subgen. and n. sp.

Type Specimen.—A maxillary fragment with $P\underline{3} - M\underline{2}$, No. 928 C.I.T. Coll. Vert. Pale., plate 1, figures 3, 3*a*.

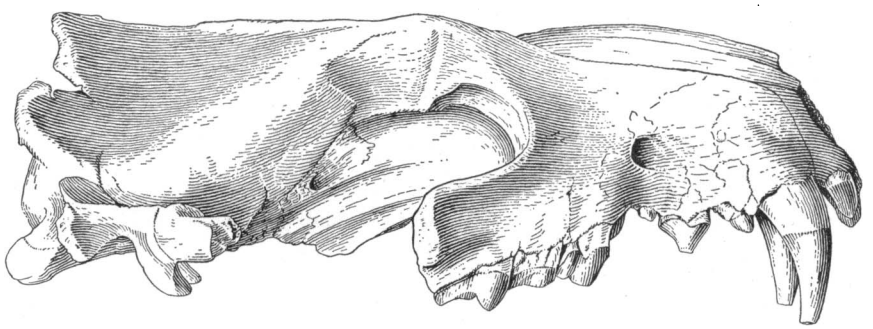

FIGURE 1

Hyænodon vetus, n.sp. Skull, No. 1243, lateral view; × 1/2. C.I.T. Coll. Vert. Pale. Sespe Upper Eocene, California.

Paratypes.—Maxillary fragment with $P\underline{4}$, $M\underline{1}$ and $M\underline{2}$ and a ramus with teeth, No. 1140 C.I.T. Coll. Vert. Pale., plate 1, figures 2, 2*a* and 4, 4*a*.

Locality.—Sespe Upper Eocene, north of Simi Valley, Ventura County, California; Locality 150 C.I.T. Vert. Pale.

Subgeneric Characters.—$P\underline{4}$ with distinct inner cusp. $M\underline{1}$ with tiny protocone. Slight bifurcation of tip of principal antero-external cusp in $M\underline{2}$.

Specific Characters.—Distinctly smaller than *Hyænodon mustelinus* and comparable in size to individuals of *H. vulpinus* from the Phosphorites of Quercy. Approaches closely in size the American species ?*Pseudopterodon minutus*. Width of $P\underline{4}$, relative to length, greater than in latter species.

Remarks.—*Protohyænodon exiguus*, in the several characters stated above, is distinctly more primitive than typical *Hyænodon*. In the former the inner lobe of $P\underline{4}$ projects inwardly farther than in the Oligocene species

and a distinct cusp is present. This region is better developed in the Simi form than in ?*Pseudopterodon minutus*. The inner face of the principal cusp facing the lobe is concave. In the American Oligocene species, where the inner cusp is not so well defined or is absent, the inner surface slopes upward from the tip of the principal cusp to the side of the lobe. In other words, the lobe supporting a cusp of its own serves less as a buttress to the principal cusp in *P. exiguus* than in the Oligocene forms. In $M\underline{1}$ of *P. exiguus* a tiny but distinct protocone is present and is defined from the inner wall of the antero-external cusp by a small furrow. The presence of an antero-internal cusp has been noted by Matthew in $M\underline{1}$ of ?*Pseudopterodon minutus*. In the Sespe species an antero-internal cusp is suggested in $M\underline{2}$, but is not so well marked as in $M\underline{1}$. At the tip of the principal cusp in $M\underline{2}$ of the type specimen of *P. exiguus* is a slight indentation of the enamel surface on both the external and internal sides, separating it into two minute parts. The separation of the tip of this cusp into two parts is to be noted in $M\underline{1}$ of the American Oligocene species but I have not observed it in $M\underline{2}$.

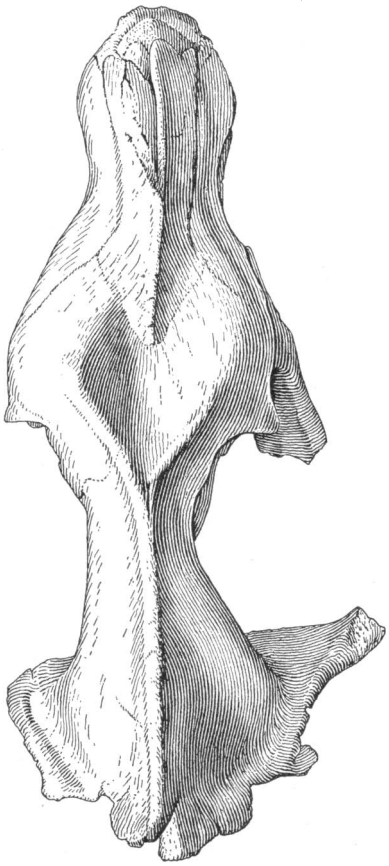

FIGURE 2

Hyænodon vetus, n.sp. Skull, No. 1243, dorsal view; × 1/2. C.I.T. Coll. Vert. Pale. Sespe Upper Eocene, California.

$M\underline{3}$ is absent, in which respect *P. exiguus* is like *Hyænodon*. In the paratype (Fig. 4*a*) minute depressions or perforations have been noted to the inner side of the posterior part of $M\underline{2}$, but it appears unlikely that these represent the remnants of the alveolus for a third molar. Moreover, the width of the maxillary wall to the inner side of $M\underline{2}$ in the type specimen is certainly not great enough to accommodate a third molar in that specimen.

Among the American species, *H. minutus*, described by Douglass[2] from the Pipestone beds of Montana, appears to show closest relationship to *Protohyænodon exiguus*. The maxillary fragment with a portion of the superior dentition later recorded by Matthew[3] from these deposits furnished

the basis for assigning Douglass' species tentatively to *Pseudopterodon*. Some doubt prevails regarding the validity of Schlosser's type for, according to Matthew, Scott has expressed belief that *Pseudopterodon* is based on deciduous teeth of *Hyænodon*. Martin[4] likewise regards this genus as having been based on the milk dentition of *Hyænodon*. In each of the upper carnassial teeth of *Pseudopterodon* the two cusps forming the antero-external region of the crown are widely spaced and their separation is much better defined than in our form. *Protohyænodon exiguus* differs from Matthew's specimen in larger size, in the proportions of $P\underline{4}$ and in the presence of a distinct inner cusp in this tooth.

Among European species, *Hyænodon vulpinus* from the Phosphorites (Quercy) resembles our type in size. This species evidently displays noteworthy differences in size. In the upper dentition of *vulpinus* $P\underline{3}$ is elongate anteroposteriorly, for the region of the crown in front of the principal cusp is extended farther forward than in American species. $P\underline{4}$ in *vulpinus* (No. 11462 Prin. Univ. Coll.) has a distinct inner cuspule. *P. exiguus* is more like *H. vulpinus* in this character than are the American Oligocene species. The protocone in $M\underline{1}$ of *vulpinus* tends to be more prominent than in the latter, in which respect our form is again more like the former.

In at least some specimens of *vulpinus* the anterior basal tubercle of $P\bar{4}$ is more prominently developed than in No. 1140 from the Sespe. In *P. exiguus* a tubercle is absent but a small cingulum is present at the antero-internal base of the principal cusp. The most noteworthy difference in the lower dentition occurs, however, in $M\bar{3}$. Relative to the length of either $M1$ or $M2$, this tooth has a greater length in *H. vulpinus* than in *P. exiguus*.

Pterodon californicus, n .sp.

The genus *Pterodon*, now recorded for the first time from an early Tertiary horizon in North America, is represented by incomplete rami of lower jaws of three individuals. In two specimens, Nos. 933 and 1213 C.I.T. Coll. Vert. Pale., the deciduous dentition is present with $M\bar{1}$ and $M\bar{2}$. No. 941, however, represents an older individual in which the permanent dentition includes not only the first and second molars, but also the third and fourth premolars.

All the specimens from the Simi Sespe show the characteristic structure of the molars in which *Pterodon* differs from *Hyænodon*. In size of talonid and size of paraconid blade in the molars these specimens are like representatives of the *Pterodon* group and differ from *Hyænodon*.

Type Specimen.—Fragment of left ramus with $P\bar{3} - M\bar{2}$, No. 941 C.I.T. Coll. Vert. Pale., plate 1, figure 6.

Paratypes.—Two left rami with deciduous teeth and first and second molars, No. 1213 (plate 1, Fig. 5) and No. 933.

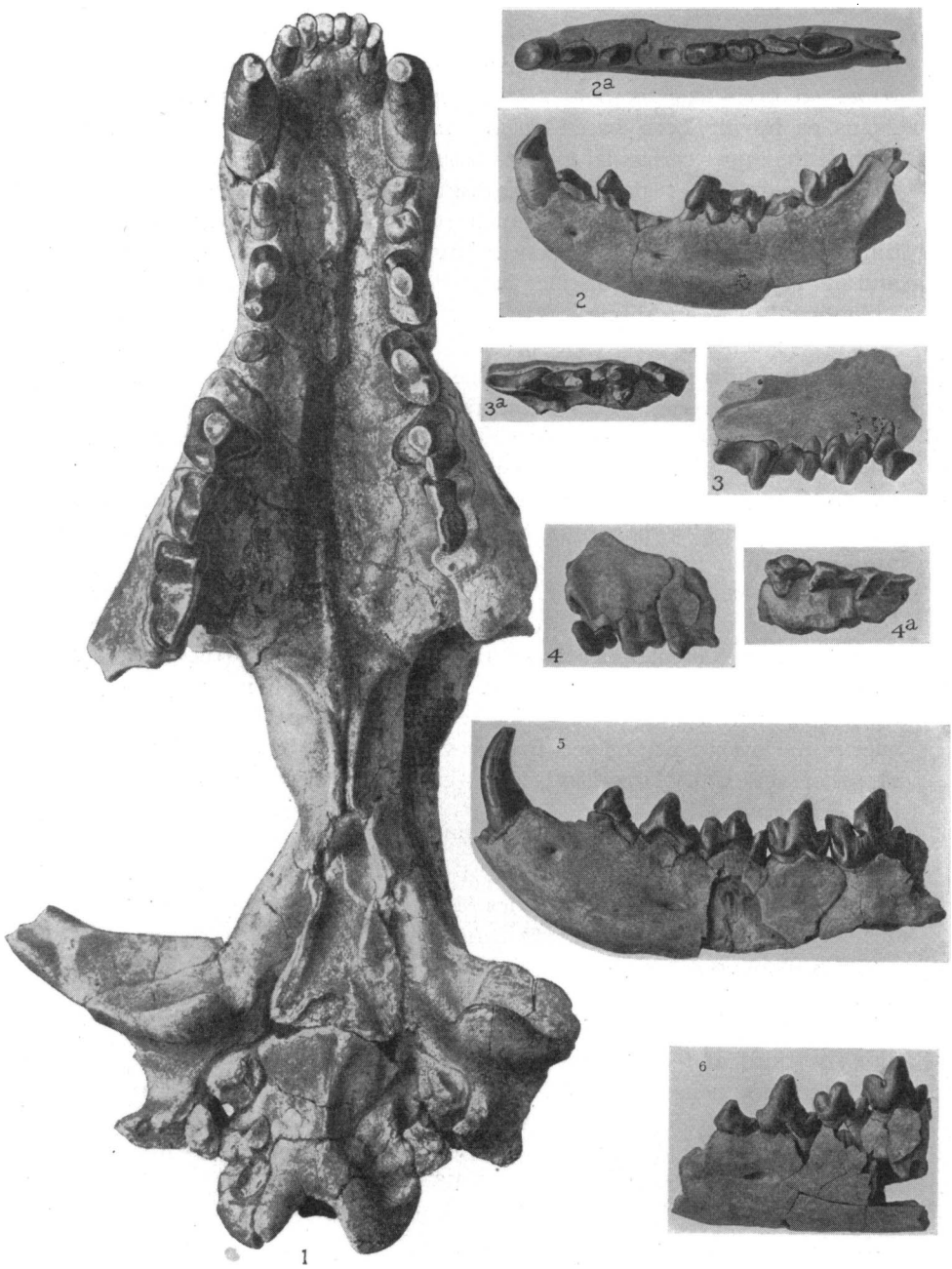

PLATE 1

(Description on opposite page.)

Locality.—Sespe Upper Eocene, north of Simi Valley, Ventura County, California; Locality 150 C.I.T. Vert. Pale.

Specific Characters.—Pterodon californicus approaches most closely in size the species *P. leptognathus* from the Fayûm, but is distinctly smaller. $P\bar{3}$ and $P\bar{4}$ distinctly more robust and anterior molars relatively smaller than in *P. leptognathus*. Decidedly smaller than *Hemipsalodon grandis.*

Remarks.—The three specimens available show the characters of the lower deciduous dentition and the acquisition of the permanent teeth. The youngest specimen, in terms of development of the dentition, is No. 933. In this jaw the milk incisors, canine and milk premolars are present. The milk incisors are crowded in transverse row with $DI\ \bar{2}$ displaced slightly backward. $DI\ \bar{2}$ and $DI\ \bar{3}$ are of subequal size. The crown of a permanent incisor is appearing behind the deciduous teeth and immediately adjacent to the symphyseal surface. $Dp\ \bar{1}$ and $Dp\ \bar{2}$ are two-rooted, with the anterior root considerably more reduced than the posterior. With reduction in size of the anterior root and procumbent position of crown, the posterior root in $Dp\ \bar{1}$ extends obliquely backward. The single alveolus for $Dp\ \bar{1}$ in No. 1213 may have accommodated not only the principal root but also the reduced forward fang. The crown of $Dp\ \bar{1}$ extends very close to the canine, flanking the lower posterior border of this tooth. The posterior root of $Dp\ \bar{2}$ likewise projects backward in the jaw. In this tooth the highest point reached by the principal cusp is situated farther posteriorly than that of $Dp\ \bar{1}$, and the crown resembles more that of $Dp\ \bar{3}$.

The structure of $Dp\ \bar{3}$ is like that of $P\bar{4}$, although the crown is more compressed than in the latter tooth. The principal cusp, which does not stand so high as in $P\bar{4}$, is slightly recurved. A tubercle of minute size is present at the antero-internal side of the base of the principal cusp, while a much larger posterior basal cusp is also present. $Dp\ \bar{4}$ resembles somewhat the first molar. It differs, however, from the latter tooth in a number of characters. $Dp\ \bar{4}$ is longer and more compressed, the paraconid and protoconid are not so blade-like and the paraconid shear shows less obliquity with reference to the anteroposterior axis of the tooth than in the first molar. A distinct talonid is present. In specimen No. 1213 the partly developed permanent premolar is seen in the jaw beneath $Dp\ \bar{4}$.

In the type specimen, No. 941, considerable disparity in size exists

DESCRIPTION OF PLATE 1

Figure 1, *Hyænodon vetus*, n .sp. Type specimen, No. 1243. Figures 2, 2a, 3, 3a, 4, 4a, *Hyænodon (Protohyænodon) exiguus*, n. subgen. and n. sp.; figures 3, 3a, type specimen, No. 928; figures 2, 2a and 4, 4a, paratypes, No. 1140. Figures 5 and 6, *Pterodon californicus*, n. sp.; figure 6, type specimen, No. 941; figure 5, paratype, No. 1213. All figures $\times\ ^3/_4$.

California Institute of Technology Collections. Sespe Upper Eocene, California.

between $P\bar{3}$ and $P\bar{4}$. $P\bar{3}$ possesses a broad base with principal cusp anterior in position. No well developed posterior basal tubercle is present. In $P\bar{4}$ the principal cusp stands high and a posterior basal cusp was presumably present although the enamel surface is marred in this region. The crown of this tooth does not tilt backward. The obliquity of the paraconid shear in the molars, relative to the fore and aft axis of the individual tooth, does not appear to be as great as that in *P. leptognathus* and approaches more that seen in *P. dasyuroides*. The posterior edge of the protoconid reaching upward for nearly half the distance between the level of the talonid and the tip of the cusp projects noticeably backward and can be readily noted in the illustration (plate 1, Fig. 5). In the more adult specimen, No. 941, this portion of the edge is worn. A characteristic enamel ridge extending for a short distance longitudinally on the antero-external surface of the base of the paraconid marks laterally the border of the area against which the tooth in front is pressed.

The posterior end of the mandibular symphysis in No. 941 reaches a point below the anterior end of $P\bar{4}$. In this specimen, also, the large posterior mental foramen lies below the anterior root of $P\bar{4}$. A distinct groove extends from this opening anteriorly, reaching a point below the anterior end of $P\bar{3}$. The very large ramus of the mandible of *Hemipsalodon grandis*, described by Cope from the White River Oligocene of Swift Current Creek, Canada, is widely removed specifically from the Californian form and is a later type.

[1] Stock, C., *Proc. Nat. Acad. Sci.*, **18**, 518–523 (1932).
[2] Douglass, E., *Trans. Amer. Philos. Soc.*, **20**, 255 (1901).
[3] Matthew, W. D., *Bull. Amer. Mus. Nat. Hist.*, **19**, 208–209 (1903).
[4] Martin, R., *Rev. Suisse de Zoöl.*, **14**, 575 (1906).